CITS4403 Computational Modelling
Project Specification

Submission Deadline: 14 October 2024, 11:59PM AWST

1 General Project Information

This project is to be completed in **a group of 2 students (maximum)**. We recommend you to come to the lecture and the lab, where you can meet others, find a group member and form a group. Individual submission is allowed for this project but please note **NO bonus mark will be given for individual submission**.

We strongly encourage healthy collaboration (please see the University of Western Australia Working in Groups Guide, and an early start on this project, so that you will have ample time to discover stumbling blocks.

Every group is required to submit the Group Registration Form (following this link) before **23 September 2024** even if you're doing the project individually. *Only ONE group member needs to submit the form for the group. Please do not submit the duplicated group registration.*

2 Project Objective

In this project, you are required to build an agent-based model and run a simulation to analyse a real-world case, focusing on its overall behaviour and trends. The case you choose can represent a real-world phenomenon of a complex system (e.g., the Sugarscape model for wealth distribution inequality in economics), or it may involve simulating a process to support or explore an existing theory (e.g., the process of natural selection in the Theory of Evolution).

There are no restrictions on the case you choose. You may select any topic of interest for your analysis. However, you are not allowed to use examples that were covered in lectures or in the suggested textbook for this unit (please see more details in Section 5).

Your project will be assessed based on the quality of your report writing and the effectiveness of your Python implementation for both the model and the simulation. Specifically,

1. **Report Writing**
    - **Clarity and structure:** How well the report is organised, including the four main sections – problem statement, model design, simulation results and analysis, and conclusion.
    - **Explanation of the model:** Clear explanation of the agent-based model, its assumptions, and the reasoning behind the design choices.
    - **Analysis of results:** In-depth analysis of the simulation outcomes, including trends, behaviours, and any real-world implications.
    - **References and citations:** Proper referencing of relevant research to support your discussion and designed model.
2. **Python Implementation:**
    - **Correctness:** The accuracy of your model's implementation and whether it faithfully simulates the intended real-world case.
    - **Functionality:** Whether the simulation runs as expected and produces meaningful, interpretable results.
    - **Code readability and documentation:** Clear, well-commented code that is easy to follow and understand.

3 Report Sections and Indicative Marks

3.1 Title

The title of your project and the author list including name and student ID.

3.2 Problem Statement [5 marks]

- **Background of the chosen case and Motivation:** Introduction to the chosen real-world case and explanation of the motivation behind your choice of case. Why this particular case is of interest to you or your team, and highlight its relevance or importance in real-world scenarios.
- **Suitability for Agent-Based Modelling:** Justify why agent-based modelling (ABM) is an appropriate method for simulating this case.
- **Complexity of the Case for Simulation:** Discuss the potential factors that influence the complexity of the chosen case in terms of simulation. E.g. How these complexities make it a valuable subject to analyse.

3.3 Model Design [7 marks]

Demonstrate clear and solid computational modelling thinking by providing a well-structured modelling process, including:

- **Model Design:** Clearly explain the design of your agent-based model, including the rules, initial configuration, agent attributes, and any relevant assumptions.
- **Complexity Reflection:** Thoroughly discuss how your model captures and simulates the complexity of your chosen real-world case, including which rules, parameters, or attributes you specifically designed to add complexity.
- **References:** Justify your model design and complexity reflection using appropriate references.

3.4 Simulation Results and Analysis [10 marks]

Visualise and analyse the simulation outcomes including:

- **Visualisation:** Present the simulation outcomes at different time steps with appropriate visualisation.
- **Quantitative Analysis:** Define a quantitative measure that represents the simulated phenomenon, and analyse how key factors influence this value with proper plots.

- **Parameter Impact:** Display and discuss how varying parameter values and initial conditions influence the simulation outcomes and the complexity of the chosen real-world case.
- **Real-World Reflection:** Discuss how the simulation outcomes reflect or provide insights into the real-world phenomenon.

3.5 Conclusion [3 marks]

- **Summary:** Summarize your work, highlighting the key insights and findings from your simulation.
- **Limitations:** Provide a thoughtful and reasonable discussion of the limitations in your model design.
- **Future Work:** Suggest potential improvements or extensions for future work based on your findings and limitations.

3.6 References

List all references cited in your report. Ensure that all references are formatted consistently according to your chosen citation style.

3.7 Appendix (optional)

You may include any additional figures or content relevant to your project in this section.

4 Submission

The submission should be made online via LMS (**The submission portal will open on 7 October 2024**). Only **ONE** group member needs to make the submission for the group.

You MUST submit two items:

- **Report:** A .pdf file named CITS44403_YourGroupID.pdf;
- **Python Implementation:** A single .ipynb file named CITS4403_YourGroupID.ipynb containing both your code and detailed documentation alongside the code.

5 Important Rules

You MUST follow the rules below. Any submission found to violate any of these rules will receive **zero marks** for this project.

1. The report must be submitted as a PDF and contain no more than **five A4 pages** of main content (excluding references and appendices).
2. The model described in the report MUST be faithful to the submitted code and running log that you submit. You MUST include the saved running log (especially for the simulation outcomes) in the submitted .ipynb file.
3. You MUST NOT directly copy any open-source project code from GitHub or other platforms.
4. You are NOT allowed to analyse cases covered in lectures or the suggested textbook, including the Shelling's model of Segregation, Sugarscape model for wealth distribution, traffic jams, bird flocks, evolution, and the Prisoner's Dilemma.